Attachment 1

Instructions for Completing Fish Passage Through Road Crossings Assessment Form to Evaluate a Sub-sample of BLM Fish Passage Culverts Replaced Between 1998-2001

This document provides general instructions and explanations to complete the fish passage through road crossings field data forms for each culvert (p. 1-13 to 1-17). The data forms provide information required for assessment of fish passage through each culvert. Information for the Site section (p. 1-13) should be placed on the form in the office. Data sufficient to use the Coarse Screen Filter (Table 1, p. 1-12) may be available from District files from past inventories or will require field data collection. In either case, enter the data for each culvert into the forms. Data required for the Coarse Screen Filter:

1. Type of structure
    a. If CMP, span and type of corrugations
2. Substrate
    a. Whether or not substrate is found throughout the length of structure
    b. Substrate depth within structure
3. Channel grade
4. Grade through structure
5. Bankfull width
6. Whether or not there is a perch (drop at lower end of culvert), and height of the perch
7. Percent blockage at the upstream opening of the structure, if any

When channel or culvert grade information are not available in the office, additional surveys will need to be completed. When the forms are completed through page 1-15, use the Coarse Screen Filter (Table 1 on page 1-12). If a rating of “Green” or “Red” occurs, no further data are needed. Submit the completed forms. If a “Grey” rating occurs, further hydraulic analysis should be performed using FishXing. Additional information and data are needed and should be entered on pages 1-16 and 1-17. Once FishXing has been run, establish whether the initial “Grey” structure rates “Green” or “Red” and submit the completed forms.

The optional tailwater cross-section information, channel roughness, and channel slope at tailwater control can be helpful for culverts that are rated “Grey.” The FishXing software is available on the web at: http://www.stream.fs.fed.us/fishxing.

"Site"

Most of this information may be collected in the office and is entered on a data sheet for each site before beginning the field portion of the assessment. Many of the fields on the form are self-explanatory.

Road / Mile post/Comments/Culvert ID Tag/Multiple Pipes: Record the road number and the mile post at the stream crossing. If the FIMMS milepost is known place that in the FIMMS milepost cell.

When traveling from the beginning of the road that the culvert crosses: An Distance Measuring Instrument (DMI) should be used to determine exact milepost where access to the culvert is from the beginning of the road. If multiple pipes are located at one crossing identify each pipe at the inlet by the odometer reading, i.e. 1.015 mile for pipe #1, 1.017 mile pipe #2, etc. For this reason, a DMI attached to the vehicle is the most accurate method and is fairly inexpensive. http://www.nu-metrics.com/ Click on NITESTAR on left column. Approximate cost is around $150-$250 for unit, installation kit, and installation. **Place in FIMMS Milepost.**

When not traveling from the beginning of the road that the culvert crosses: Travel time to culverts can sometimes be minimized by accessing them from a different road then what the culvert crosses. Culvert Inventory Tag ID number should be used. This number should correspond to the future FIMMS number, such as road number plus approximate milepost (1900011.25). The reason for this is to have a unique culvert identifier so the Forest can find the exact culvert again. Ultimately, FIMMS is the best tool for identifying culverts, so updating the database to remove the Culvert Inventory Tag ID with the FIMMS milepost should be done as soon as possible. Write in the milepost comments section description of point of references to find the culvert again (e.g. 1.5 miles from intersection of road 123 with road 145)

Optional Information: GPS LAT/LONG(decimal degrees), Stream LLID (unique control number for routed stream), Stream Measure (unique identifier along routed stream), FEAT_CN (FIMMS generated feature control number), and State Identifier.

6th Field Watershed: Enter the Hydrologic Unit Code (HUC) number of the watershed or sub-watershed.

Legal/Quad/Ownership: input the legal (T,R,SECTION, ALIQUOT PART(1/4 NE, 1/4SW), the quad, and ownership.

Surveyors: Record surveyors names here.

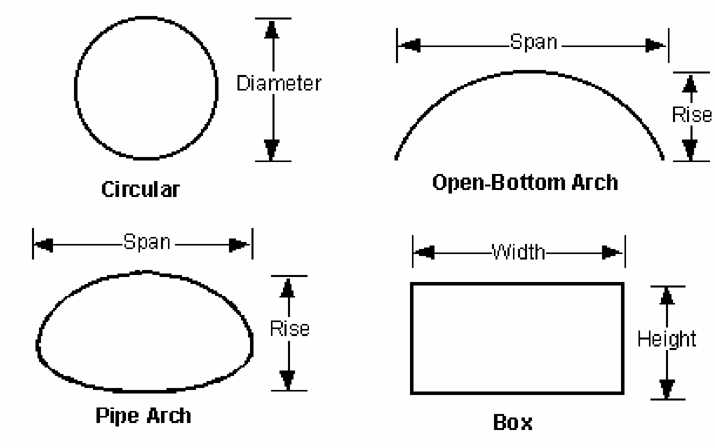
Field Date: The date the field data is collected should be entered here.

Stream Name: From USGS 7.5' quad or other local sources.

"Culvert/Channel" (Note: all equations for slopes are based on assuming an elevation at the level NOT just by reading the rod height and taking the differences. Slopes should be negative (except maybe the inlet gradient) and perch and depths should be positive.)

Pipe Shape: Choose appropriate type of culvert. Depicted below are the end-sections of common culvert types. (Not all are noted below but the most popular ones are.

Vertical Size = diameter, rise, and height Horizontal Size = span and width



FORD: Note if there is a low flow water crossing and make comments on condition and problems.

Vertical Size: The height, rise, or diameter (measured vertically) of the culvert, measured from the inside of the corrugations. If the culvert bottom is completely covered with bedload (embedded) estimate the culvert height based on the shape (e.g. assume the height = width for circular culverts). For Open-Bottom Arches, measure the height from the streambed to the top of the culvert.

Horizontal Size: The maximum width, span or diameter (measured horizontally) of the culvert as measured from the inside of the corrugations. It is important to measure both the height and width on circular culverts since they often become squashed after installation.

Material: If the culvert material does not fall into one of the following categories, give a brief description characterizing the roughness of the material and input closes material type into the database.

CMP = Corrugated Metal Pipes are constructed of a single sheet of corrugated galvanized steel. May be annular or spiral. Spiral pipes have helical corrugations reduces the culvert roughness.

Aluminum = Corrugated aluminum, no rust line.

PVC = Plastic that often has corrugations.

Concrete = Most box and some circular and arch culverts are constructed of concrete.

Log = Includes log stingers and some log box culverts.

Wood = Includes some older box and circular culverts that are constructed of wood.

SSP = Structural Steel Plate pipes are constructed of multiple plates of corrugated galvanized steel.

Pipe construction - corrugations: Measure the width and depth of the corrugations in inches. Most CMP have 2 2/3 in. x ½ in. corrugations. SSP pipes often have 6 in. x 2 in. corrugations. The size of the corrugations determines the culvert roughness.

Culvert Length: The culvert length should be measured between the surveyed inlet and outlet points. Culverts that are +100 ft and/or steep slopes calculate horizontal length; otherwise use field determined slope length (on shorter distances and flatter sites where the difference will be minimal).

Inlet and Outlet invert elevations: Invert is the bottom inside surface of the culvert. It is convenient to set up your level at a location that allows a clear line-of-sight to all the required survey points. This will avoid the need to move the instrument and keep the survey calculations simple. Often the easiest location to set up your level is in the channel directly downstream of the culvert. At crossings with small fills, the level can also be located on the road above the culvert. The site characteristics will generally dictate where you can set up the level.

Culvert Slope: **(FRAME OF REFERENCE: all slopes shall be taken from the reference point of looking downstream. Therefore, all slopes shall be inputted as a negative.)** Culvert slope is determined by the outlet invert elevation minus the inlet invert elevation divided by culvert length, multiplied by 100. The difference between upstream and downstream elevation is measured with a rod and hand level or more sensitive instrument. The minimum equipment required for surveying is a level (Philadelphia) rod, measuring tape, and either an auto level mounted on a tripod, total station or laser on a tripod. When surveying breaks-in-slope within the culvert a flashlight and pocket stadia (Philadelphia) rod may also be required. Note: this number is automatically calculated for you in the database.

It is important to tie all surveyed points to a common datum. The center of the culvert inlet bottom is often used, but any point that can be reoccupied in the future will suffice. An elevation must be assigned to the datum (100ft is commonly used). Then rod heights surveyed with the level are converted to elevations relative to the datum and entered on the data sheet. This may require a piece of scratch paper or calculator.

Fill Volume: **(Skip this field in the form. This information is not needed for the review of replaced culverts, but would be useful for initial evaluation of a culvert.)** Estimating the fill volume is useful when attempting to prioritize stream crossing replacements. Excavation of existing fill can add substantial cost to a project. Conversely, when stream crossings with large fill volumes fail they can deliver greater amounts of sediment directly into adjacent streams. Dramatically undersized stream crossings with large fill volumes, even if they are not fish barriers, may need to be replaced.

Lu: Upstream fill slope length, measured from toe of the fill at the culvert inlet to inboard edge of road surface.

Su: Upstream fill slope, measured with hand level.

Ld: Downstream fill slope length, measured from toe of the fill near the culvert outlet to outer edge of road surface.

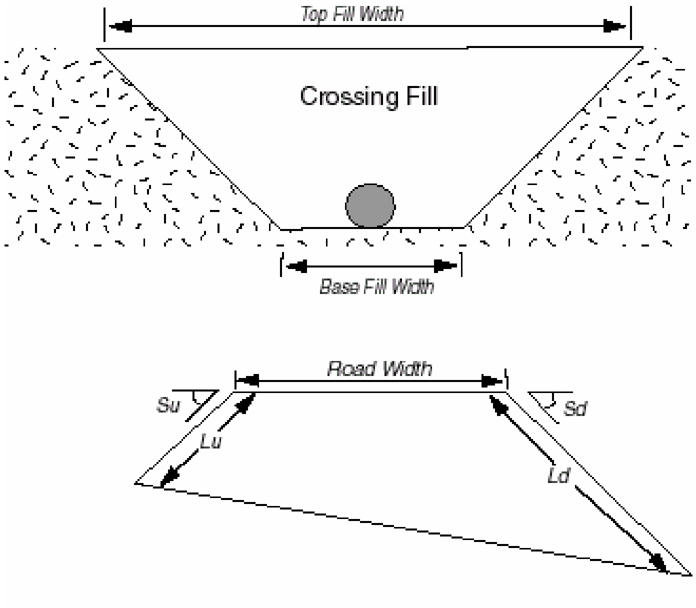
Sd: Downstream fill slope, measured with hand level.

Road Width: Width of the road above the stream crossing, measured perpendicular to the road centerline. For this project, the idea is to determine fill volumes needed so the total subgrade roadbed width is necessary, not just the travel way. This is to get an idea of the approximate fill.

Top Fill Width: Width of the fill measured along the road centerline and perpendicular to culvert axis.

Base Fill Width: Width at the base of the fill (original channel width) measured perpendicular to culvert axis.

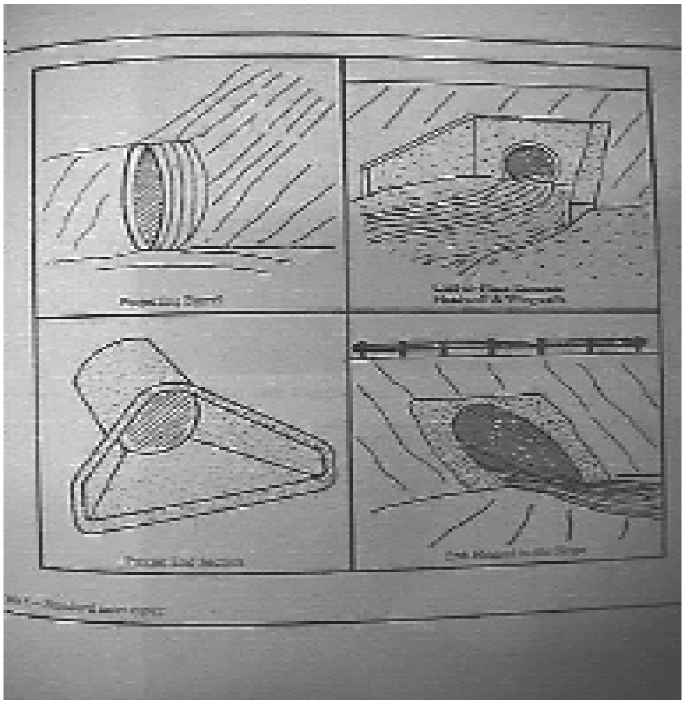
For a description of how to calculate the fill volume refer to Flanagan et al. (1998), which can be downloaded at:



Crossing fill measurements. Note that Ld, the downstream fill slope length often extends below the culvert outlet. These measurements are for obtaining a rough estimate of the fill volume and not intended for use in contract specifications.

http://watershed.org/wmc/pdf/xing_handbook.pdf

Culvert Inlet Type: Circle the inlet description that most closely matches the situation. The culvert inlet type will change the headloss coefficient at the inlet of the pipe. This coefficient is a measure of the efficiency of the inlet to transition flow from upstream into the culvert smoothly.



Above are the four main types: (from top left going clockwise) projecting, headwall and wingwall, mitered, and wingwall.

Baffles: If the culvert contains baffles or weirs, circle yes/no and note the type and give a brief description. Since baffle designs are often not standardized, a sketch of the retrofit/design along with dimensions is extremely useful.

Breaks in Slope Inside of Culvert: Does the culvert have any, yes or no? Make sure they are actual breaks and not just debris build up. If removing the debris would eliminate the break, it is not a slope break. Estimate horizontal distance to the break from the outlet and estimate the vertical difference.

Installation Grade:Sunken or Embedded: If the culvert has stream substrate retained within at least a third, and in some cases 20%, of the culvert consider it sunken. Estimate the depth of the substrate at the inlet and outlet. Estimating the culvert height and substrate depth can be difficult with pipe arch and box culverts that contain sediment throughout. Best estimates of the sunken depth will suffice. Only mark "Yes" if the pipe is sunken throughout. If it is not, check "No" but place the sunken depth in this cell if there is some substrate.

Inlet Blocked: If the inlet is blocked it will affect the rating of the pipe. Select the blockage that applies.

"Channel"

Outlet Pool Condition (OPC)

If the culvert outlet is perched directly over the outlet plunge pool, the following measurements are appropriate. **(SEE THE DRAWING FOR A DETAILED PROCEDURE WHEN LOW FLOW DOES NOT OCCUR AND THE RESIDUAL POOL DEPTH IS NOT OBVIOUS):**

Residual Pool Depth: This is the depth of the pool measured at its deepest point if the water flow was turned off and the pool drained to the point where the top of the pool is equal to the pool tail crest height or hydraulic control.

"D" (Vertical Leap Distance): This is the perch measurement. The distance from the bottom of the culvert outlet to the residual pool elevation in the plunge pool is recorded in this space. It is roughly the height the fish would need to jump. This is determined from the equation shown on page 3 and is automatically calculated in the database.

"L" (Horizontal Leap Distance): This measurement is the distance a fish would need to jump from the center of the plunge pool to the inlet of the culvert. It is the distance measured from the estimated center of the plunge pool to the outlet invert of the culvert.

Channel Gradient(one representative gradient): **(Reference: looking downstream so slope shall be negative.)** Channel gradient is the difference in the elevation of the water level measured at two points along a stream divided by the length of channel between those two points. The measured length should follow the stream's course and not the shortest distance between two points. Take one representative measurement of either the upstream and downstream channel gradients by moving above and below the culvert influence area. Get the maximum distance between the points that visual contact will allow. The distance is dependant upon brush in the area. Minimum distance should be 8-10 feet. **Measure gradient from water surface to water surface.**

Gradient from pipe inlet one pipe diameter upstream: **(Reference: looking downstream so slope will probably be negative.)** Undersized culverts can influence channel morphology and the bank full water level for several hundred feet upstream as a result of high flow pond formation and sediment deposition. Fish passage will be impaired if channel gradient directly above the pipe is steeper then the average channel gradient. Measure the channel gradient from the upstream culvert invert, one pipe diameter distance upstream. Measure gradient from substrate.

Bankfull channel widths (BFW) (one representative): Measure the width of the channel at the bankfull level that should be measured beyond the influence of the culvert. Bankfull flow is a winter high or peak flow that usually occurs on average every 1 to 2 years. It is below the stream's flood flow level. Look for indicators on each bank of the highest annual water scour marks. Use a pin or flagging to mark the elevation of the points on each bank, then measure the stream's width between them. The most consistent indicators of bankfull flow are, the top of unvegetated gravel bars or deposits, a change in vegetation, bank /topography, or the size of streambed material. Other indicators are, a line defining the lower limit of lichen colonization, exposed roots, a stain line visible on bare substrate, or an undisturbed line of organic debris on the ground.

BFW ratio: The ratio of the horizontal size of the pipe over the bankfull channel width. This measurement is calculated automatically in the database.

Span to Bankfull Ratio
If a culvert is undersized, it can constrict the stream flow during fish migration periods. Water will pond at the culvert inlet creating a hydraulic pressure head, the water at the inlet is higher than the water inside the culvert. A hydraulic head produces pressure causing the water to accelerate as it enters the culvert resulting in excessive velocities that can be a barrier to fish passage. The span to bankfull ratio can be used as a coarse screen to detect excessive stream constrictions caused by undersized culverts. However, if the stream is unconfined, wide and shallow, the bankfull width can give a false indication of quantity of water in the stream when compared to the culvert span (as an indicator of the capacity of the culvert). **Caution should be used if this is the only evaluation criterion that results in a "red" finding**. Placing the culvert into the "gray" category may be appropriate until further evaluation is done to determine if the culvert is causing a flow constriction.

Fish Passage Result: Evaluation Criteria:Green/Red/Grey: Using the evaluation criteria, circle green if the stream crossing is not a fish passage barrier. Circle red if a definite fish passage barrier is present. If fish passage is undeterminable, circle grey and gather the optional tailwater cross-section data if you would like to use the FishXing software to help answer the fish passage question. The database will do an automatic rating system. The Forest may place their ranking in the database in the cell below the database generated result. Make sure that a reason is given in the comment field for the difference.

Barrier is there for a reason: If the culvert is a barrier due to fish management benefits note it here by answering yes or no.

For grey pipes only…Culvert and Channel Substrate: Manning's Channel Roughness Coefficient: This describes how much resistance the streambed material will have on the stream's flow. Smooth bed material, such as bedrock, imposes less resistance and results in faster flows or a lower Manning's coefficient. The rougher the material, the more the resistance, resulting in slower flows or a higher Manning's coefficient. Estimate what the composition of the bed material of the pipe streambed and immediately downstream of the cross-section. Classify the dominant substrate of both the channel and inside the culvert. See inventory sheet for selection options.

"Problems"

Potential Problems: Note items that are listed in survey sheet that is occurring. Select the item that closely describes the situation as possible.

"Species"

Fish Species and Passage Requirements: List up to five species and associated age classes of fish that the stream crossing should pass in both directions. Primary fish should be the weakest species, otherwise the species that the forest would design the culvert to pass. The species should be inputted as: #1 Priority species, #2 second weakest species and etc. **DO NOT INPUT BOTH LIFESTAGES OF A SINGLE SPECIES. INPUT ONLY THE WEAKEST. UNLESS THIS ASSUMPTION IS NOT VALID: IF A JUVENILE RAINBOW EXISTS THEN ADULT RAINBOWS DO ALSO. INPUT JUVENILE.**

Length of upstream habitat: If the surveyed culvert is a barrier, this will assist in quantifying the amount of potential habitat that can be made accessible if the barriers are removed. What is the length in miles of stream channel that is, or would be accessible to fish assuming no barrier exists downstream. **INPUT IN MILES.**

"Graphic"

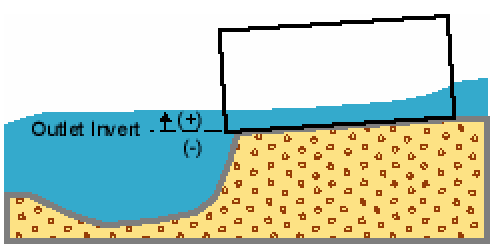
Photo numbers: Photos should be taken of both the culvert inlet and outlet. Record the photo numbers here. Information on the culvert should be included on a marker board that is in the photo. A photo of the top of road and surrounding areas is useful in determining if a culvert or a bridge would fit to the site. Many times a sketch is more valuable then a photo. If this is a difficult site to photograph, include a plan view or cross section sketch at the end of the form.

"Cross Section": (PRE-PROJECT: GREY PIPE IN HIGH PRIORITY AREAS ONLY WHERE A CONSTANT TAILWATER IS NOT POSSIBLE)

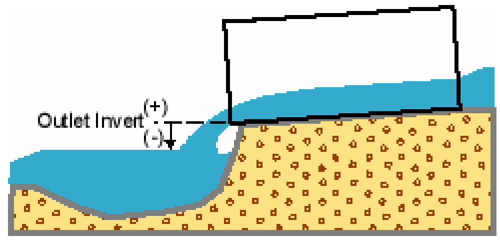
Tailwater Depth: Tailwater depth is the water depth immediately downstream of the culvert outlet measured from the culvert outlet bottom (invert). The tailwater cross-section is used to estimate the tailwater elevation at different flows by constructing a flow verses tailwater elevation rating curve. This method is most appropriate for stream crossings with unimpeded flow downstream of the outlet and possessing little or no outlet pool. It can also be used successfully when the tailwater control is the pool tailout. Although cross-sections of downstream weirs cannot be used explicitly in FishXing, they can be informative when attempting to estimate water elevations at various flows.

The cross-section should be located at the tailwater control perpendicular to the stream channel. Cross-sections typically start on the left bank looking downstream. String a measuring tape across the channel from left to right. Make sure the first survey point is well out of the channel. Proceed to survey along the tape, taking points at each break in slope. Record the station (distance across the channel as indicated on the tape) and survey the rod height. The rod heights must then be converted to elevations relative to the datum. Also record points of interest, such as the locations of the bank full.

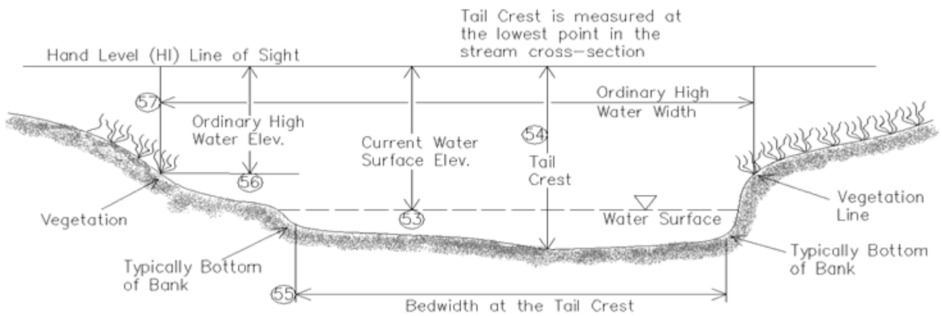
- Positive depths occur when the tailwater elevation is greater than the outlet bottom elevation. No leap is required for the fish to enter the culvert when the Tailwater Depth is positive.



- A negative tailwater depth occurs when the tailwater elevation is less than the outlet bottom elevation. This occurs when the culvert outlet is perched above the downstream channel. This situation may require the fish to leap in order to reach the culvert outlet.



NOTE: If the tailwater depth is greater than both the critical and normal depths, a backwater effect may be caused in the culvert. In general, backwater effects are beneficial to fish passage because they reduce water velocities and increase water depth. Check the water surface profiles (WSP) to determine the extent of the backwater effect.
Note: use self level and rod where vegetation will allow instead of hand level,



Typical Tail Crest Cross–Section

Channel Slope at Tailwater Control: The slope of the channel reach leading downstream from the tailwater cross-section. The change in elevation of the channel thalweg over a measured length will be used to calculate the slope.

Select the length of channel to measure. The channel reach should begin at the cross-section and continue until the channel slope or width noticeably changes, typically 20 to 30 feet. Survey the thalweg near the tailwater control and record the rod height. Then proceed to survey the thalweg at the downstream end of the selected reach. Record the rod height and measure the distance between the two points. The change in the rod height divided by the length will give you the channel slope downstream of the tailwater control.

Information to consider for the Comments Section

Site Sketches: Include plan or cross section sketches to help tell the fish passage story. At many sites a sketch is more valuable then a photo.

Upstream Culverts: If any culverts exist upstream within the range of historical habitat, make note. Do not count culverts that are on historically non-fish bearing portion of the stream.

No. of Culverts: Number of upstream culverts.

Barriers: Are any of these culverts barriers to upstream fish movement? To answer this question, a complete analysis of the upstream culverts may be required.

Distance: If there are upstream culvert barriers, measure the stream distance from the culvert inlet to the first upstream culvert barrier. This is best done using a hip-chain, but can be estimated using air photos or USGS topographic maps.

Downstream Culverts: Are any culverts downstream of the stream crossing?

No. of Culverts: Number of downstream culverts.

Barriers: Check yes if any of these culverts are barriers to upstream fish movement. To answer this question, a complete analysis of the downstream culverts may be required.

Distance: If there are culvert barriers downstream, measure the stream distance from the culvert outlet to the first downstream culvert barrier.

Inlet/Channel Alignment: The approach angle of the upstream channel. Standing at the inlet looking upstream estimate the approach angle of the channel with respect to culvert centerline.

Cascade over riprap = Culvert outlet is perched above the downstream channel and exiting water sheets over riprap or bedrock making it difficult for fish to swim or leap into the culvert.

Outlet Apron: Aprons are commonly constructed of concrete or grout and extend downstream from the culvert outlet. They are typically designed to prevent erosion at the toe of the stream crossing fill. Place this in comment section by shape if the culvert has an outlet apron and give a brief description. Note if the end of the apron has a weir or influences the flow within the culvert. Include a sketch on the back of the data sheet if needed.

Channel approach angles greater than 30 degrees can increase the likeliness of culvert plugging, which results in blockage of both upstream and downstream fish movement and can result in catastrophic failure of the stream crossing. Additionally, in some situations poor channel alignment can create adverse hydraulic conditions for fish passage.

Other (FishXing information for Grey culverts only)

The FishXing software is available on the web at: http://www.stream.fs.fed.us/fishxing. See instructions and help files prior to running the program.

Not all the information necessary to run the program successfully is included in the assessment. Other items that need to be placed into the program for grey culverts that are not field items are:

-Hydraulic Criteria	Low Passage Flow and High Passage Flow
-Compute Water Surface Profiles at these Flows	(Range of three flows (cfs))
-Velocity Reduction for Fish	Velocity reductions at inlet, barrel, and outlet due to location of culvert on migration path. (see FishXing help files page 9 for more information)
-User or Default Swim Speeds	Determine which is applicable
-Fish size	(mm)
-Minimum water depth	For fish to swim in (ft)
-Migration Season	Months of the year that fish migrate

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Table 1. Coarse Screen Filter – Fish passage evaluation criteria				
	Structure	Green[1]	Grey[2]	Red[3]
1	Bottomless pipe arch or countersunk pipe arch, substrate 100% coverage and invert depth greater than 20% of culvert rise.	Installed at channel grade (+/- 1%), culvert span to bankfull width ratio of 0.9 to 1.0, no blockage.	Installed at channel grade (+/- 1%), culvert span to bankfull width ratio of 0.5 to 0.9, less than or equal to 10% blockage.	Not installed at channel grade (+/- 1%), culvert span to bankfull width ratio less than 0.5, greater than 10% blockage.
2	Countersunk pipe arches (1x3 corrugation and larger). Substrate less than 100% coverage or invert depth less than 20% of culvert rise.	Grade less than 0.5%, no perch, no blockage, culvert span to bankfull ratio greater than 0.75.	Grade between 0.5 to 2.0%, less than 4" perch, less than or equal to 10% blockage, culvert span to bankfull ratio of 0.5 to 0.75.	Grade greater than 2.0%, greater than 4" perch, greater than 10% blockage, culvert span to bankfull ratio less than 0.5.
3	Circular CMP 48 inch span and smaller, spiral corrugations, regardless of substrate coverage.	Culvert gradient less than 0.5%, no perch, no blockage, culvert span to bankfull ratio greater than 0.75	Culvert gradient 0.5 to 1.0%, perch less than 4 inches, less than or equal to 10% blockage, culvert span to bankfull ratio of 0.5 to 0.75.	Culvert gradient greater than 1.0%, perch greater than 4 inches, blockage greater than 10%, span to bankfull ratio less than 0.5.
4	Circular CMPs with annular corrugations larger than 1x3 and 1x3 spiral corrugations (>48" span), substrate less than 100% coverage or invert depth less than 20% culvert rise.	Grade less than 0.5%, no perch, no blockage, culvert span to bankfull ratio greater than 0.75.	Grade between 0.5 to 2.0%, less than 4" perch, less than or equal to 10% blockage, culvert span to bankfull ratio of 0.5 to 0.75.	Grade greater than 2.0%, greater than 4" perch, greater than 10% blockage, culvert span to bankfull ratio less than 0.5.
5	Circular CMPs with 1x3 or smaller annular corrugations (all spans) and 1x3 spiral corrugations (>48" span), 100% substrate coverage and substrate depth greater than 20% of culvert rise.	Grade less than 1%, no perch, no blockage, culvert span to bankfull ratio greater than 0.75	Grade 1.0 to 3.0%, perch less than 4 inches, less than or equal to 10% blockage, culvert span to bankfull ratio of 0.5 to 0.75.	Culvert gradient greater than 3.0%, perch greater than 4 inches, blockage greater than 10%, culvert span to bankfull ratio less than 0.5.
6	Circular CMPs with 2x6 annular corrugations (all spans), 100% substrate coverage and substrate depth greater than 20% of culvert rise.	Grade less than 2.0%, no perch, no blockage, culvert span to bankfull ratio greater than 0.75	Grade 2.0 to 4.0%, less than 4" perch, less than or equal to 10% blockage, culvert span to bankfull ratio of 0.5 to 0.75.	Grade greater than 4.0%, greater than 4 inch perch, greater than 10% blockage, culvert span to bankfull ratio less than 0.5.
7	Baffled or multiple structure installations		All	
8	Log stringer or modular bridge	No encroachment on bankfull.	Encroachment on bankfull (either streambank).	Structural collapse.

[1]Note: Larger corrugations increase roughness allowing for fish passage at steeper culvert gradients

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[2] Grey – Conditions at the crossing may not be adequate for fish passage, additional analysis required.
[3] Red – Conditions at the crossing are assumed not adequate for fish passage.
[1] Green – Conditions at the crossing are assumed adequate for fish passage.

Fish Passage Through Road Crossings Assessment

"SITE" **(REQUIRED = *)**

***District:** ______________________________

***Preparer Names:** ____

Culvert ID Number]: ____

____________________________ **Field Office** ***[Road Number:** ______________________

***6th-Field Watershed:** _ _ _ _ _ _ _ _ _ _ _ _ ***7.5-minute Quad:** __________________

***Land Ownership:** __ **BLM** __ **Other:**____

***UTM (GPS) Location:** ____

Legal Description: T._ _ **N. R.** _ _ . _ **E. S.** _ _ **¼ S.** _ _ **of** _ _ **(Aliquot Part)**

Field Date: _ _ / _ _ / _ _ _

***Stream Name:** ___________________________________

Lat: ________ Long: _________ Stream LLID: _________ Stream Measure(km): ________

State Identifier(ID): ____________

"CULVERT/CHANNEL"

***Pipe Shape:**	Horizontal size		Vertical size		
__ Box	Width	_ _ _	Height	_ _ _	(Inches)
__ Circular (longitudal/elliptical(vertical)	Dia.	_ _ _	Dia.	_ _ _	(Inches)
__ Open-Bottom Arch	Span	_ _ _	Rise	_ _ _	(Inches)
__ Pipe-Arch (squashed/elliptical(horizontal)	Span	_ _ _	Rise	_ _ _	(Inches)

*(round to nearest inch)

__ Other: Low Flow Crossing (Ford)

Shape Comments ___________________________________ (list here if longitudal, elliptical, etc.)

***Construction:**

- __ 2 2/3 X ½ inch corrugations
- __ 3 X 1 inch corrugations
- __ 5 X 1 inch corrugations
- __ SSP 6 X 2 inch corrugations
- __ Smooth

***Pipe Material:**

- __Annular CMP
- __Aluminum
- __Concrete
- __Log
- __PVC
- __Spiral CMP
- __Wood
- __Other:_______

“CULVERT/CHANNEL” cont.

(Reference: Upstream to Downstream Measurements and Observations:)

***Inlet Invert Elevation:** _ _ _ . _ _ Feet (If no TP needed Rod Height (RH1) = elevation)

(If TP is needed. Otherwise if you cannot see both inlet and outlet from only one instrument location then need to take these additional measurements and/or do calculations):

Station 1 (HI1): _ _ . _ _ ft (measure with tape measure)
Assumed Elev _ _ _ ft (using 100 ft is an easy way to it)
RH1: _ _ . _ _ ft (read rod height @ inlet invert)
Elevation = _ _ _ . _ _ ft
(Assumed Elevation _ _ _ ft) + (HI1 _ _ . _ _ ft) – (RH1 _ _ . _ _))

***Culvert Inlet Type (circle one):**

Headwall Mitered Projected Wingwall(10-30 degs) Wingwall(30-70 degs)

***Road fill upstream:** (Lu) _ _ _. _ (feet) (visual estimate only. DO NOT MEASURE)

***Inlet Blocked?** (circle one): not blocked less than 10% blockage greater than 10% blockage

Channel Description - Upstream

	Distance	Rod Height(RH2)	Upstream (calculation)
Gradient from pipe inlet one pipe diameter upstream (substrate)	_ _. _ _ ft	_ _ . _ _ ft	(RH2 –RH1)/Distance _ _ . _ % (_ _ ._ - _ _. _)/_ _._

***Culvert Length:** _ _ _ . _ Feet (use slope distance EXCEPT if culverts have large slopes AND lengths over 100 feet. See instructions page for this information.) (float tape measure from inlet to outlet and get invert to invert.)

***Pipe Baffles:** Yes / No

Breaks in slope inside of the culvert: Yes/No

Estimated Horizontal Distance to break from outlet (feet): _ _. _
Estimated Vertical Distance to break (feet): _ . _

***Sunken ? (Yes/No)** (Answer “Yes” only if coverage = 100%; “No” if < 100% coverage)

***Sunken Depth:** _ _ . _ _ Feet
Substrate Ratio : . _ _ Feet
(sunken depth *12) / rise

***Road fill downstream:** (Ld) _ _ _. _ Feet (visual estimate only. DO NOT MEASURE)

***Outlet Invert Elevation(P1)**: _ _ _ . _ _ Feet (If no TP: P1=RH3= _ _ . _ _)
(If TP take below measurements and do these calculations):

HI at Sta. 2 (HI2): _ _ . _ _ ft (measure with tape measure)
Backsite Sta. 1 to get RH @ HI1 _ _ . _ _ ft (read)
Elev. at Sta. 2 = _ _ _._ _ ft (calculate)
(Assumed elevation at station 1 from above _ _ _ ft)+(RH@HI1 _ _ . _ _ft)-(HI2 _ _ . _ _ ft)
Outlet Invert Elevation: _ _ _ . _ _ ft (calculate then place above)
(Elev @ sta. 2 _ _ . _ _ft)+(HI2 _ _ ._ _ft)-(RH3 _ _ . _ _ ft)

***Culvert Slope:** %__________ (Reference: looking downstream so value should be a negative number)
Culvert Slope = (outlet invert elevation – inlet invert elevation) / culvert length * 100

***Road Width:** _ _ . _ _ Feet

“CULVERT/CHANNEL” cont.

***OUTLET POOL CONDITIONS (OPC)** (These are rod heights you are measuring except the horizontal distance)

Pool Bottom Elevation (P3): _ _ . _ _ Feet Tailcrest Elevation(P2): _ _ . _ _ Feet

P1(invert elevation (RH3) from page 2:): _ _ . _ _ Feet

Calculations: (computer will do them for you but do calculations if you do not have laptop in field with you)

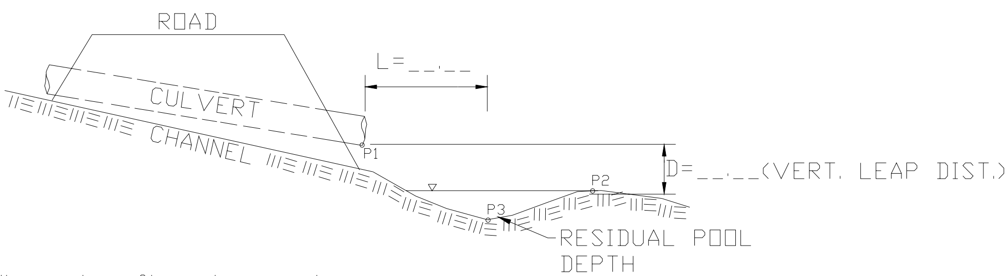
OPC Residual Pool Depth (P2 _ _ . _ _)-(P3 _ _ . _ _ ft) = _ _ . _ Feet

OPC Vertical Leap (P1 _ _ . _ _ ft) – (P2 _ _ . _ _ ft) _ _ . _ Feet

OPC Horizontal Leap Distance: (L) _ _ . _ Feet

(Note: these equations are where an elevation is assumed at the level station, say 100 feet. When simply reading the rod and taking the differences in elevations (no turning point is necessary) then just reverse these equations(P2-P1, etc). We want the perch and depth to be positive numbers.)

Sketch Outlet Pool



Where low flow does not occur:

1. P1 is known from page 1, Outlet Invert Elevation ____.__(feet).
2. Determine P2 ____.__(feet) (measure tailcrest substrate).
3. Measure Length from culvert invert outlet to thalwag. (L)
4. Determine P3 ____.__(feet) (measure thalwag pool substrate)
5. OPC Residual Pool Depth = P2 - P3.
6. Vertical Leap Distance = perch = P1 - P2.

Other Channel Descriptions

	Upstream	**Downstream**	**Representative Measurement**
***Channel Gradient** **(water surface)**	Not Applicable	Not Applicable	_________ % (make negative to correlate with a negative culvert slope)
***Bankfull Width** **straight stream section**	Not Applicable	Not Applicable	_______(feet) ***BFW Ratio=_____**

***EVALUATION (Fish Passage Result): GREEN RED GREY**

IF BARRIER, IS BARRIER NECESSARY TO MEET FISH MANAGEMENT OBJECTIVES? BARRIER OK? (YES/NO)

(NOTE: further information may be needed if the culvert is evaluated as grey. See last page of explanations/instructions for more information.

ESTIMATED: (QUICK VISUAL ESTIMATE ONLY)
Culvert Substrate Coefficient (substrate of pipe channel): (circle one)

Culvert (metal) Concrete Sand/gravel Bedrock
Gravel/Cobbles Cobbles/boulders Boulders/Log Weirs

Channel Substrate Coefficient (dominant substrate of channel): (circle one)

Sand/gravel Bedrock Gravel/Cobbles
Cobbles/boulders Boulders/Log Weirs

"PROBLEMS"

Potential Problems - Culvert Condition (circle as many as appropriate)

bent inlet bottom worn through water flowing under culvert debris in culvert

Other: ___________________________

"SPECIES"

PRE-ASSESSMENT FISH/STREAM INFORMATION (ALL INFO NEEDED)

***FISH SPECIES AND PASSAGE REQUIREMENTS: (type and age)**
(List three species and life stages maximum. LIST BY PRIORITY. #1 IS HIGHEST TO #5 LOWEST)
Species Life stage (ONLY the critical lifestage. Either juvenile or adult. NOT BOTH)
1.
2.
3.
4.
5.

***LENGTH OF UPSTREAM HABITAT: (projected miles existing that could be opened up)**
1. _____________ miles Comments: ____
2. _____________ miles Comments: ____
3. _____________ miles Comments: ____
4. _____________ miles Comments: ____
5. _____________ miles Comments: ____

"GRAPHIC" (OPTIONAL INFORMATION-ITEMS ARE FOR DISTRICT BENEFIT ONLY)

Summary

Type	Number	Remarks	URL

"GRAPHIC" (OPTIONAL INFORMATION-ITEMS ARE FOR FOREST BENEFIT ONLY) cont.'

OVERALL SKETCH: (Quick 2 minute sketch. Only capture items difficult to see in photos)

"CROSS SECTION" (PRE-PROJECT: GREY PIPES IN HIGH PRIORITY AREAS ONLY NEED THIS INFORMATION WHERE A CONSTANT TAILWATER IS NOT APPLICABLE!!!)

Tailwater Cross-Section Optional **Use culvert inlet bottom as datum**															
Station (ft)															
Elevation (ft)															
Notes (POI)															

NOTE: see last page of "Explanations and Instructions for Fish Passage Assessment Through Road Crossings Form" for more information about the FishXing software and other non-field data that is needed for running the program.

POI notes: